



THE UNITED STATES DISTRICT COURT  
FOR THE EASTERN DISTRICT OF MICHIGAN

RELUME CORPORATION

Plaintiff,

v.

DIALIGHT CORPORATION,  
ECOLUX, INC.,  
PRECISION SOLAR CONTROLS, INC.  
LUMILEDS LIGHTING BV,  
PHILIPS LIGHTING BV, and  
HEWLETT-PACKARD COMPANY,

Defendants.

Case No. 98-72360

Judge John Feikens

Magistrate Judge Thomas  
A. Carlson

DECLARATION OF PETER HOCHSTEIN

1. My name is Peter Hochstein. I submit this Declaration in support of Relume's reply brief on the preliminary injunction motion. I earlier submitted my declarations in connection with the opening brief. The following information is based on my personal knowledge and I am competent to testify as to it at trial or hearing.

2. This Declaration is addressed to three general topics: (1) defendants' infringement, (2) the validity of the '645 and '909 patents, and (3) misstatements of fact about what I told the industry at ITE performance specification committee meetings.

3. First, I disagree with defendants' joint contention of non-infringement of the '645 patent. I have reviewed defendants' position that the absence of a ballasting resistor in their LED array precludes infringement. This is incorrect. For one thing, my claims do not require a ballasting resistor. No mention is made of such resistors in the LED array claim element. Second, the "corresponding structure" of the LED array does not include the ballasting resistors as described in

the patent specification. It merely includes the parallel strings of series connected LEDs. (See '645 Patent, 6:24-25). Third, even if the corresponding structure included ballasting resistors, their absence, if at all, in the accused devices is not a substantial difference from their presence in the context of the LED array element. This is because the LED array element functions to produce light. Resistors per se do not produce light. Finally, in some sense, current sensing resistors (which all defendants have) perform a ballasting function, albeit small. For all these reasons, I do not agree that the lack, if any, of ballasting resistors is relevant at all to defendants' infringement.

4. Next, I disagree with defendants' joint contention that they do not have voltage regulation. Attached as Exhibit 1 to this Declaration is a chart based on analysis conducted under my supervision of all of defendants' accused products. It shows that as a.c. input voltage is varied over the specified range of 80 to 135 volts r.m.s., d.c. output voltage remains essentially constant, i.e., less than a 5% total variation for an input voltage change of over 68%. This is the sense in which I used the term "voltage regulation" in my written description. (E.g., '645 Patent, 10:14-17). Indeed, Exhibit K in our original filing contains Dialight's admission that their 432 Series signals "feature Voltage Regulation."

5. I understand that defendants' wish to construe my "voltage regulation" language as limited to (1) constant output voltage with variation in load impedance, (2) constant output voltage with variation in ambient temperature, or (3) a power supply structure that does not utilize current sense circuitry. I did not mean for any of these to be the exclusive definition of "voltage regulation." In fact, the primary function of my voltage regulation circuitry is to accommodate the very large differences in a.c. power line voltage over which the LED signal must operate. Defendant's definition number 1 defines a fault condition, i.e., either shorting or opening one or more LEDs in

the array. It ignores the normal operating condition that load impedance (and hence voltage) is expected to stay constant. Definition number 2 simply does not address the objective of maintaining constant light output over a wide range of a.c. input voltages. Definition 3 offers a structural, not a functional, definition of voltage regulation, and hence does not apply. It also fails on its own terms, since defendants' power supply parts actually do measure or sense voltage. Voltage is directly proportional to the current flowing in the sense resistors, and the particular input pin coupled to the sense resistors senses voltage (V-in), not current.

6. I now address defendants' arguments directed to validity. First, I disagree that the '909 patent is invalid over the Fujitsu reference. I have specifically focused on claim 9. The reference is not directed to my field of art (safety critical outdoor LED signals). ('909 Patent, 1:9-10). Rather, it is directed to "light sources for illumination," and particularly "facsimiles, image scanners, and copiers etc." These LEDs are not designed to be perceptible by people in ordinary operating conditions, but instead are designed to be detected by electronic photo sensors. It is the nature of such detectors to be more responsive to pulsed LEDs rather than continuously operating LEDs. It is a design goal for systems such as that disclosed in the Fujitsu reference to optimize the signal to noise ratio by concentrating the radiant energy into a relatively narrow high peak power pulse, rather than a filtered or otherwise substantially d.c. radiation. Pulsing without filtering is common practice in machine vision applications.

7. My field of work was far removed from machine vision. In my '909 patent, I endeavored to solve the problem of making LED traffic signals safer, and more functionally equivalent to incandescent bulbs. The Fujitsu reference is not in this field of endeavor. Further, since the Fujitsu reference it is directed to the problem of optimizing machine detection of reflected

light, is not reasonably pertinent to the problem of optimizing the safety of safety-critical outdoor signaling devices as was my '909 invention.

8. In addition, I understand that the pertinent standard for determining whether an invention is invalid for obviousness is whether, at the time of the invention, one of ordinary skill in the relevant art would have found the differences between the prior art and the claimed invention to have been within his level of skill to bridge, and there is some teaching, suggestion or motivation in the art to bridge such differences. I disagree that an initial case of obviousness has been made. I consider that the relevant art is traffic signal technology. I believe the level of ordinary skill is a bachelor's degree in electrical engineering, with two to four years of experience in the field.

9. More specifically, it is well known that the specific type of detector that would be employed with the Fujitsu illumination circuit is a pulse sensitive detector. See Exhibit 2, attached hereto. To insert a filter in the Fujitsu circuit would be contrary to high power efficiency and optimal S/N ration. This is because such a filter would reduce the a.c. (pulse) component in the signal, and therefore would interfere with the operation of the a.c. (pulse) detecting circuit. Insertion of such a filter would tend to spread the pulse, resulting in lower "detectable" power. While d.c. detection is certainly possible, such d.c. operation of optical detectors is not consistent with drift free, high S/N ratios which are naturally desirable. If d.c. detection were to be used, the new "filtered" level would have to be made equal to the previous "peak" level, greatly reducing efficiency. Nothing in the Fujitsu reference suggests this is a good idea, since it would undermine efficiency. From this I conclude that Fujitsu teaches one of ordinary skill in the art away from the addition of a filter. Therefore, I conclude that the Fujitsu reference would not have rendered my '909 invention, claim 9, obvious.

10. Using the same standards, I also disagree that the '645 patent would have been obvious over the prior art. I specifically focus on claim 5. I understand that the defendants are asserting that a combination of the Johnson patent, Figure 8, and the Hildebrand patent would have rendered claim 5 obvious. For several reasons, this is incorrect.

11. First, the asserted combination does not result in the claimed invention. Notably, there is no LED array in Figure 8 of the Johnson patent (as recited in my LED array claim element), since it depicts a simple series string. Various industry specifications prohibit implementation of such a topology because a single point failure will result in complete loss of light. This problem is addressed in column 1 of my '645 patent.

12. In addition, the Hildebrand patent does not meet the "adaptive clamp" limitation, since the Hildebrand circuit is neither adaptive, nor a clamp. My "adaptive clamp" as claimed in the '645 patent requires that its circuitry switch in and out below and above a certain input voltage, 40 volts r.m.s. in the preferred embodiment. ('645 Patent, 6:39-45). That is what makes it "adaptive." By contrast, there is no such switching disclosed in the Hildebrand circuit.

13. Further, my "adaptive clamp" as claimed requires that its circuitry "clamp," i.e., maintain at prescribed levels the input voltage when operating (10 volts r.m.s. in the preferred embodiment). By contrast, Hildebrand describes itself as a "dynamic load circuit." This is not a clamp. Further, mere inspection of its circuit characteristics as shown in Figure 4 proves that Hildebrand is essentially linear over its operating range, and is necessarily dissipative.

14. Under my supervision, an exact copy of the Hildebrand circuit was built and tested. None of the measured parameters would permit this device to be used in any sanctioned LED traffic signal. The Hildebrand circuit does not address power factor and harmonic distortion. In fact, due

to its use of a large capacitor that my '645 patent specifically avoided ('645 Patent, 8:2-3), the total harmonic distortion and power factor performance of the Hildebrand circuit is poor. In our tests, we placed a completely resistive load across the Hildebrand circuit in order to learn its optimal circuit characteristics. Even with a purely resistive 15 Watt load (which is more forgiving than a typical LED load), we measured a power factor of 0.71 and total harmonic distortion of 89.9%. Exhibit 3 shows a chart comparing this poor performance with the performance of a circuit constructed according to the teachings of the '645 patent, and with the pertinent industry specifications.

15. Another poor characteristic of the Hildebrand circuit is that it dissipates significant power in the input voltage operating range of 80 to 135 v.a.c. Exhibit 4 shows (1) a graph of power dissipation of both the Hildebrand circuit and my adaptive clamp and (2) a graph of current consumed as a function of input voltage for both the Hildebrand circuit and my adaptive clamp. These graphs show that between 80 and 135 v.a.c., especially on the lower end of the operating range, the Hildebrand circuit exhibits a significantly greater waste of energy than does the '645 adaptive clamp. At 80 v.a.c., the wasted power is as much as 4 Watts (compared to 0.25 Watts in the '645 adaptive clamp), which may amount to about 50% of the power consumed by a 200 mm red LED traffic signal. Incidentally, in testing the Hildebrand circuit, we discovered that Figure 4, while generally accurate in the shape of the pertinent curves, significantly understates dissipated current.

16. For all these reasons, the Hildebrand circuit is thus totally incompatible with the stated purpose of my '645 patent to maximize power factor, minimize total harmonic distortion, and minimize parasitic dissipation. I conclude that the respective circuits are not only not interchangeable, but one of ordinary skill (or any skill) in the art would never have considered using the Hildebrand circuit topology in combination with a power factor corrected LED array. Nor would

one of ordinary skill have been motivated or taught to modify the Hildebrand circuit (or the Johnson Figure 8 circuit) to arrive at my invention of claim 5. The Hildebrand circuit was directed to neon and fluorescent illumination elements, in which power factor is so low and total harmonic distortion is so high that the deleterious effects of adding the Hildebrand circuit to such an arrangement went unnoticed. Nowhere does Hildebrand, or Johnson, suggest an appreciation of the unique problems associated with power quality in an LED traffic signal.

17. I believe it is also pertinent that Dialight just received U.S. Patent No. 5,833,355 on November 10. It is based on applications filed in January and August, 1996, respectively. I have reviewed the electrical schematic in Figure 5 of that patent. It represents the state of the art before my developments. Notably, there is no power factor correction, no voltage regulation, no current regulation and no adaptive clamp. Attached as Exhibit 5 are true and correct copies of patents acquired by Ecolux, Precision Solar and Dialight. These patents relate to LED traffic signal technology. Each of these defendants are members of the ITE and its relevant LED traffic signal committees.

18. On a separate issue, I understand that defendants are relying on Relume's alleged failure to pass the Caltrans specification. Defendants are apparently referring to a weight requirement (2 kg) that did not exist at the time Relume submitted its product for evaluation under the Caltrans specification. I believe that weight requirement materialized after this case was filed. See Exhibit 6, August 17, 1998 Caltrans specification; Exhibit 7, August 2, 1998 Letter from Peter Hochstein to Caltrans.

19. Attached as Exhibit 8 is a true and correct copy of a form I received and returned completed in February 1998 to the ITE. It includes a reference to my '645 patent under the heading

"PUBLIC STATEMENTS AND POSITIONS." Thus, I formally disclosed my '645 patent to the ITE at least as early as February 1998.

20. Before any of Relume's patent applications issued as patents, their contents were kept secret consistent with good business practice. Relume considered them to contain trade secrets.

21. During the pendency of such patent applications, including those that led to the '909 and '645 patents, I did not know whether I or Relume would ever receive an issued patent. As I understand it, Relume had no patent rights until the issue dates of such patents.

22. It has never been the practice of ITE members to exchange, or otherwise discuss, pending patent applications.

23. I understand that defendants contend that I and Relume misled them into thinking that Relume would never assert its patent rights against them, based on my membership on various ITE committees. I am dumbfounded by this, particularly since I never tried to hide the fact that I and Relume were seeking patents for our advances. If Relume had any idea that its membership on various ITE committees would later be construed as a grant of a royalty free license to practice its trade secrets and patents, it would never have joined such committees.

24. For example, I recall an ITE meeting that occurred on April 27, 1997 at the Washington, D.C. headquarters of the ITE. I was one of about 30 people at that meeting. I recall that representatives of all defendants were in attendance there. After Dr. Berry Koch of LumiLeds gave a technical presentation on the severe thermal environment of LED traffic signals, a general discussion commenced. During this discussion, a representative of one of the LED signal manufacturers (I believe it was a representative of McCain Traffic Supply) pointed out that the addition of luminous antidimination circuitry in LED traffic signals was difficult or impossible. I



addressed that comment by telling the committee that it was not impossible and Relume had developed a proprietary means to accomplish that goal. I also mentioned Relume had a pending patent application involving such antidiminution circuitry. At that point, a brief and spirited discussion ensued where one members attending the meeting stated his objection to Relume acquiring patents that might impact his business. I then addressed Jim Keaton of 3M, a co-chair of the committee, and specifically asked him if he believed that Relume was justified in patenting some of the technology we had developed. His response was that he saw no problems arising from such endeavors, and the issue was not discussed any further.

25. Finally, I understand that Defendants argue the following paragraph shows Relume is acquiescing in defendants' infringement of its patents:

We are submitting the proposed specifications in good faith, and do not intend to use them for competitive advantage. Relume will make available any proprietary technology to the rest of the Industry in order to improve the acceptability, functionality and reliability of L.E.D. traffic signal devices.

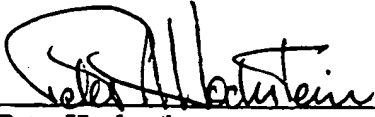
This paragraph is the last paragraph in a letter I submitted to Jon Frank, acting committee chair of the relevant LED signal ITE committee at the time, July 1995. At this date, we had not yet filed our applications that led to the '645 and '909 patents.

26. Defendants are taking my words out of context. This statement when taken in context was intended to convey that Relume's initial proposed specifications (which do not remotely resemble the final ITE specifications that were published three years later) did not describe any existing Relume product, but rather represented my perception of how a high quality LED traffic signal ought to perform. As the rest of my letter clearly reveals, I simply wanted to contrast what I was doing (i.e., proposing a specification that set a high standard for quality and performance) from

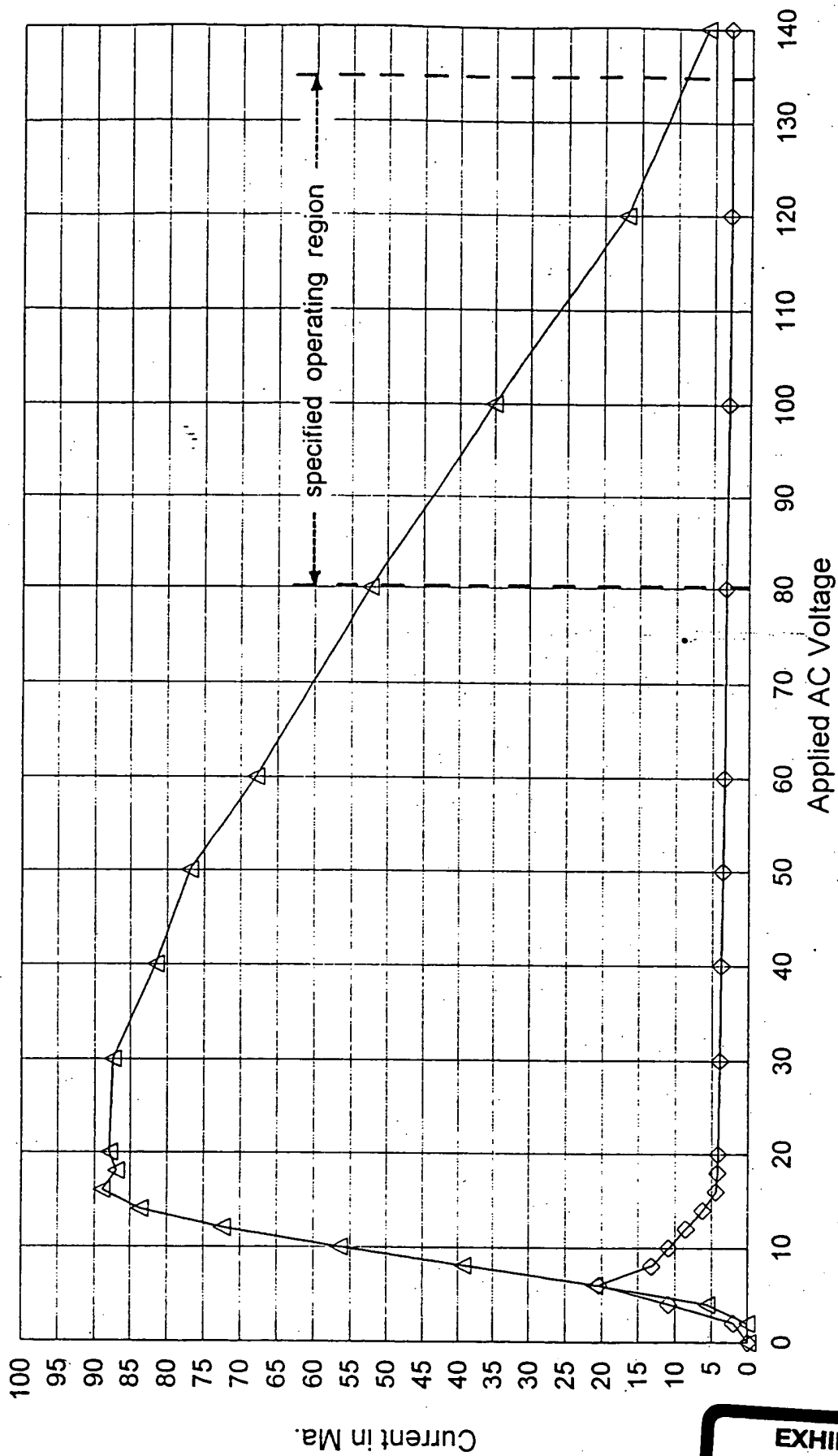
what I perceived others in the industry were doing (i.e., proposing a specification that conformed to existing product, regardless of quality). As for "making available" proprietary technology, Relume has done just that in its repeated exclusive licensing offers, commencing as early as October 1997. Thus, I never expected that anyone would treat my committee work in attempting to make LRD traffic signals safer and more efficient as any kind of acquiescence or abandonment of proprietary rights. In fact, I used the word "proprietary" deliberately to telegraph that Relume considered its technical advances to be proprietary.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: December 1, 1998

  
Peter Hochstein

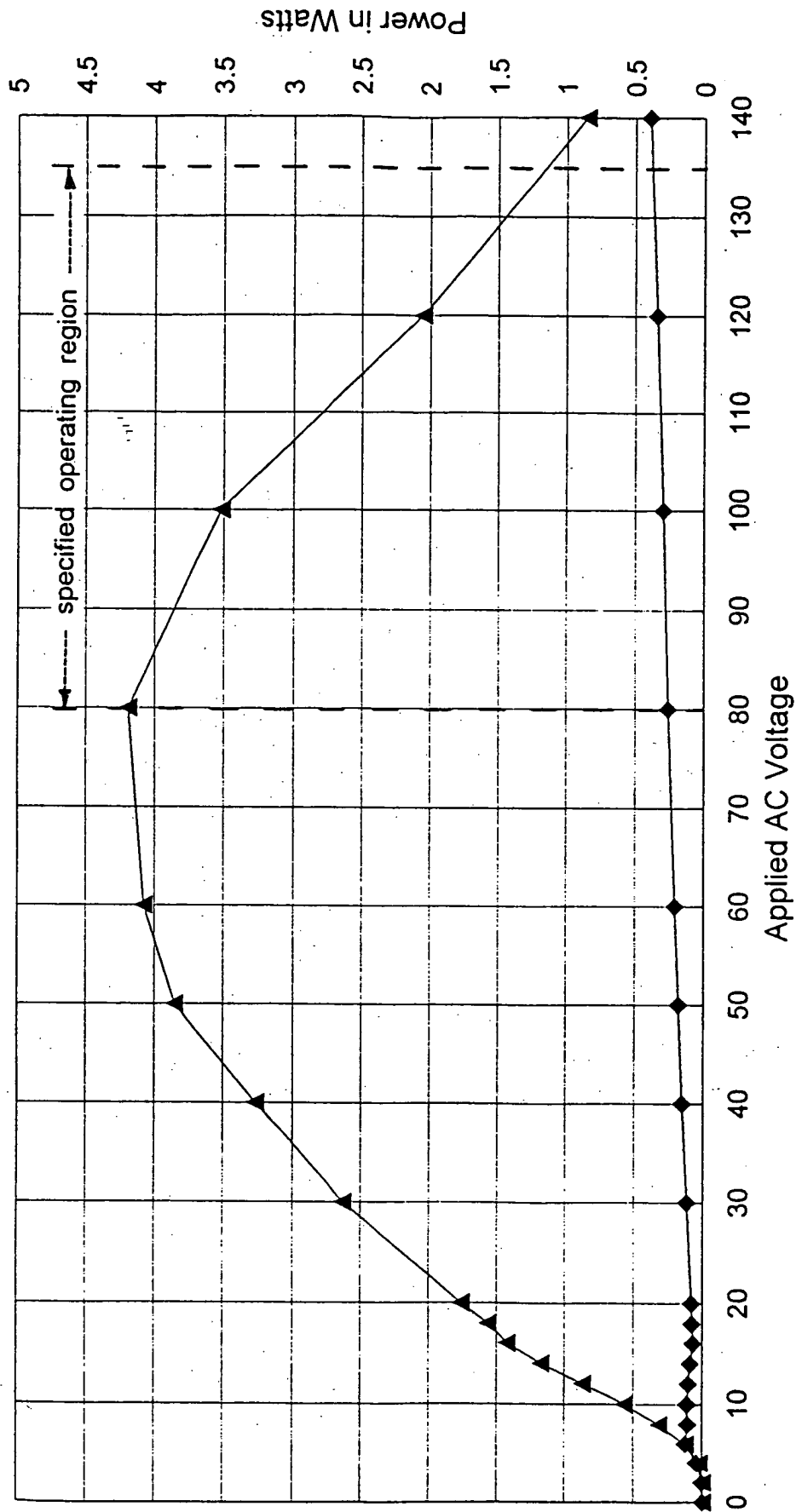
**'601 Dynamic Load Current VS: '645 Clamp Current**



△ Hildebrand Current    ◇ Relume's Current  
 '601 patent                      '645 patent

# Power Dissipation

Patent '601 VS: '645



▲ Hildebrand Power ◆ Relume's Power

'601 patent '645 patent